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EDITORIAL

Colonies for Agricultural Graduates. Much has been said and written in recent times about the utility of starting agricultural colonies for the educated unemployed. "Back to the land" has been prescribed as one of the potent specifics against the chronic drift of the intellectual power from our villages to urban areas and against the too obvious preference amongst our educated persons to petty Government posts on starvation wages over the healthy and manly though arduous life of the agriculturist. The critics of this scheme deplore that, agricultural profession at present is uneconomic and that our present system of education does not fit our young men for the monotonous and the none-too-safe profession of our rural parts. There is also the point raised by the Government that suitable land for agricultural colonisation is not plentiful. No apology is needed for publishing elsewhere in these pages a scheme prepared by one of our Agricultural graduates for the acceptance of the Government. We do not overlook the fact that the scheme elaborated therein is not entirely flawless. In fact no such scheme can possibly be complete in itself at the initial stages when the details for the site selected for the colony have not even been fully gone into. This, however, should not preclude us from expressing our opinion on the essentials.

In reviewing a scheme of the type under consideration it is necessary to recall the experiences gathered from past attempts. The Annamalai University scheme for colonisation is one such scheme attempted in this presidency, while the unemployed graduates colonisation scheme in the Punjab and the Anglo-Indian colonisation scheme in Bihar are two notable examples in other parts of India. Reports are contradictory about the success of these ventures, but one outstanding thing that comes to light from these various attempts is that, any such scheme to be successful should embody the following essentials.

(1) *A sufficiently large holding for each individual.*

(2) Adequate capital to tide over the initial period of the life of the colonist.

(3) *A planned scheme of cropping, providing a large area to be planted under remunerative crops.*

(4) A co-operative system of purchase of requirements and sale of produce.

(5) Adequate number of educated colonists, to provide a corporate life and an enlightened social atmosphere.

(6) Men trained in the profession.

(7) Effective control by the Agricultural Department.

We are satisfied that the scheme described in these pages has attempted to fulfill all these conditions. We are particularly happy to note that the scheme is on the model of the "fruit grants" so successfully in operation for over two decades in the canal colonies of the Punjab. The Indian Mildura Fruit Farm, consisting of an area of about 750 acres granted by the Punjab Government to Captain Mitchell and the Montgomery Fruit Farm covering an area of about 175 acres granted to Dr. G. S. Cheema about 15 years ago are standing examples of the success of colonisation schemes on large holdings. In these two instances the Government did not give any financial assistance to the grantees, but in the scheme under review, suitable financial aid is sought from the Government to offset the smaller area earmarked for each lessee.

The scheme is so prepared, that in the long run it is expected to be definitely a paying proposition to both the parties. The success of the project would depend a great deal on the right type of personnel selected for the scheme. We hold that the scheme could be turned to success and would eventually establish beyond doubt the value of training imparted in the Agricultural College and Research Stations. The scheme is well worth a trial and we sincerely hope that the Government will be pleased to give their support to the scheme. It takes nearly a decade to know how a scheme has fared and any new scheme should not be held up on the score that a final verdict on the success of the previous scheme is not available. Good agricultural material is made available every year and it is well such material is used up in some scheme or other without allowing it to go to waste. We feel confident to say that the training given in the college here would justify itself if scope for its expressions is held out as suggested elsewhere.

Tea Cultivation in S. India.

By E A. STONE,

Gajam Mudi Estate, Anamalais.

(Continued from page 121.)

Pruning and Plucking. By two and half to three years from planting the tea plants will have grown to a height of roughly seven feet, and the stem will be about an inch thick at the bottom. It is now time for the first prune, which simply consists of cutting across the stem at about 3″ above ground level. The result is that a number of branches grow up and out from the stump. These are left to grow for about two years more, and then pruned again at 9 inches. When the new shoots grow again after the 9″ prune they are 'tipped', or broken across, at about 6″ above the pruning level i. e. 15″ from ground level. Usually about 3 tipping rounds are necessary at intervals of 10 days or so to get all the primary branches tipped in to a level, and the time from pruning to the first tip is roughly 3 months—depending on the weather. The leaf obtained during the tipping rounds, i. e. from the primary shoots, is big in size, contains a very high percentage of water in comparison with other leaf, and would make very poor quality tea. It is qenerally thrown away. When the secondary shoots are well grown it is time for the first round of 'plucking'. The first leaf to be formed in the secondary shoot is very tiny and smooth edged, and is called the 'fish leaf'. Thereafter the ordinary big leaves are formed alternately on each side of the stalk. The method of plucking is to break off two open leaves and a bud leaving, one big leaf above the 'fish leaf' (see figure—1). The big leaf that is left, forms the mother leaf for the new shoot which will grow in its axil.

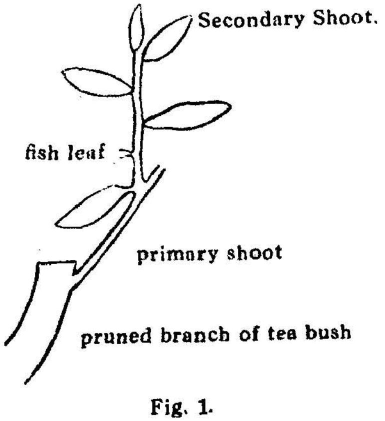


Fig. 1.

For the fist year and a half or two years after pruning it is usual to try to keep a definite level surface on the bush by plucking nothing below the level and breaking back high shoots. This does not mean that the bush is

kept down to the original tipping level all this time. This would necessitate very hard and continual breaking back which would eventually kill the bush. In the bad seasons, especially, the level is raised gradually by reducing breaking back to minimum. In vigorous growing seasons hard breaking back is necessary to keep the levels of the bushes and stop them from growing up out of control. Many planters allow all shoots above the level to be plucked to the fish leaf also, during the 'rush months'. These are usually April and May when showers of rain punctuate the periods of hot sunshine, and herald the approach of the monsoon. One bad season is June—July—August when the sun is scarcely seen, and high winds and rain are the prevailing conditions, with periods of fog and mist in between. The other bad season is the dry weather—January, February, and first half of March as a rule. The months between the monsoons and the dry weather when the rains are diminishing and the sun appears more, produce good crops but not as good as April and May.

To continue with the story of the tea bush, most planters prune on a three year cycle, and usually twice a year. That is twice a year 1/6th of the area of a tea estate will be pruned. Some start pruning in the monsoon and go on steadily until 1/3 of their estates are pruned. Some prune out every 2½ years, but it is argued that while this may increase crop (as crop drops in the third year from pruning) it reduces quality, as leaf from more mature branches gives better quality than that from green immature shoots. A few prune every four years but this usually means that the tops of all bushes have to be 'skiffed' (slashed across) after the third year. A bush which being pruned again after three years is plucked to a level for at least half that period for a number of reasons. First the spread of the bush is being increased as the slow growing side branches are being left unplucked and so thicken out and form good wood at their bases. Secondly by leaving all the leaf below the level in the centre and on the side branches, the bush is able to carry on with the formation of its organic food, even though the vigorously growing centre branches are being continually broken back, and the whole top surface is being plucked. Thirdly a far bigger surface of bush is able to absorb the sun's energy in this way, than if the bush were cone-shaped so that a healthier bush and a larger crop results.

After the second prune subsequent prunes are usually at 3 inches above each preceding pruning level, and subsequent tippings are at 4 to 5 inches above the pruning levels, though some planters prefer a higher tip.

When pruning, the ideal to be aimed at is an even distribution of points, or pruned branches, so that bunches of branches growing up in one place are thinned out by cutting some off at their bases. All cross branches running across the other branches instead of radiating outwards from the centre are cut off, all dead wood is carefully cleaned out, and living stumps shaved down to level with the new wood, so making it easy for new bark (callus) to grow over and cover the scar. Sometimes a few branches

are left unpruned so as to provide the bush with a little organic food-producing mechanism so reducing the shock of pruning. This method is known as 'lung-pruning'. It is unwise to leave too many of these "kickers" as they are called, for although they help the bush to bud much earlier and so come into bearing more quickly, the result will be an early appearance of 'banji' leaf.

A digression is necessary here to explain the 'banji' which is a leaf without a stem bud at its base. When a 'banji' leaf forms at the end of a stalk it means that for a time that stalk will not form any more leaves, and it is therefore a resting device, which if appearing in quantity, means a big reduction in crop. Healthy bushes do not run to 'banji' in any great quantities if plucked carefully for about two years from pruning, but much more 'banji' is formed in the third year. (It is for this reason that third year fields are usually called '*banji kadus*' Bushes which are brought back into leaf too quickly by leaving too many 'kickers' tend to form 'banji' one year after pruning.

To continue with pruning :— Some planters prune (and pluck) to flat level (*meshe mattam*), whereas others prune to the slope of the ground (see figures 2 and 3 showing the methods on a steep slope). It obviously makes little difference which method is used on ground which does not slope steeply, but on steep ground there is a lot of difference. The supporters of the flat method hold the view that sloping runs contrary to natural growth and gives a bush which is tremendously exaggerated on the upper side. The supporters of sloping, point out that they are forming a continuous cover so reducing weeds, and that flat pruning in later years when the bushes are bigger results in pluckers being unable to reach the lower halves of the bushes as they become exaggerated on that side.

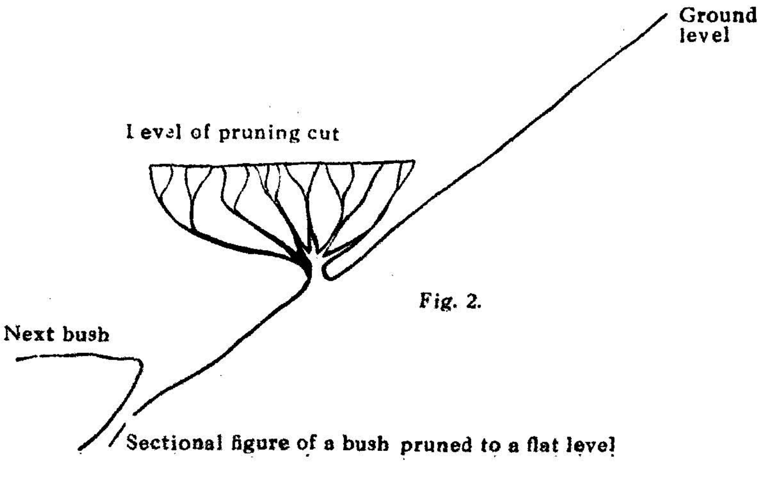
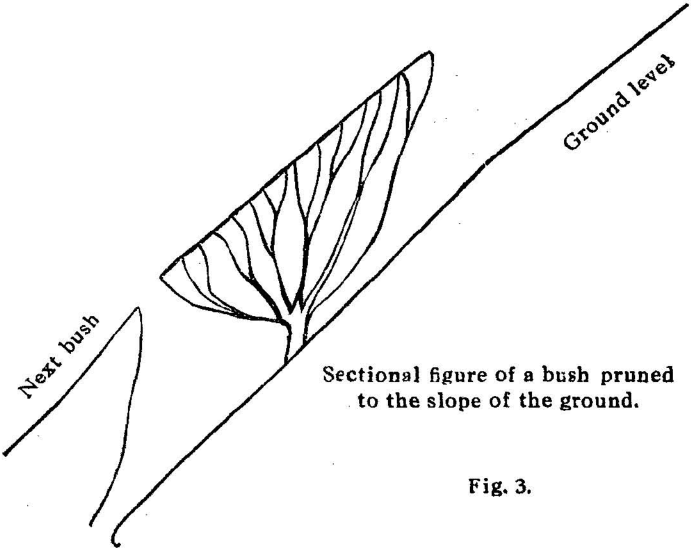


Fig. 2.

Sectional figure of a bush pruned to a flat level



Sectional figure of a bush pruned to the slope of the ground.

Fig. 3.

The possible answer is the happy medium as it is in most controversies (see fig. 4.)

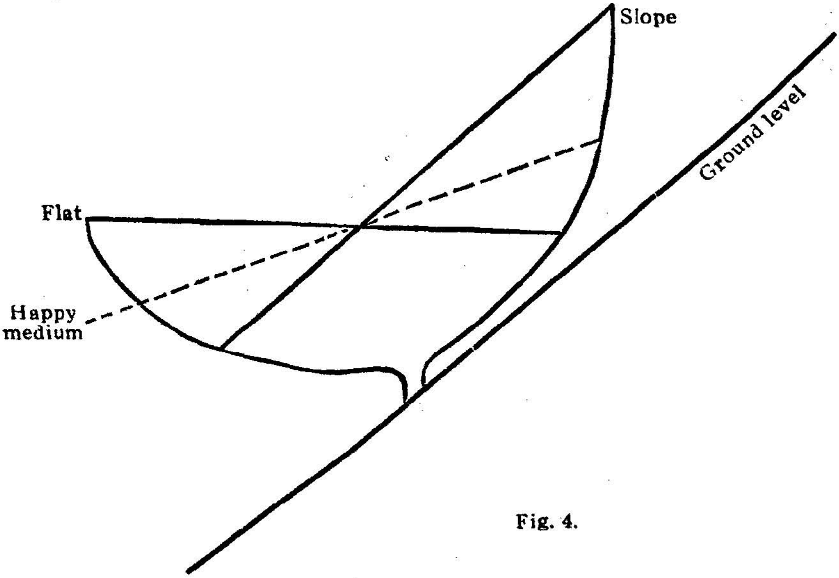


Fig. 4.

The dotted line shows the compromise, which gives a bush which is not exaggerated on either side, and is sloped sufficiently for plucking purposes even on steep ground.

A bush having the same amount of spread on either side should grow more evenly and the branches up which a uniform supply of sap is rising

should thicken evenly. After pruning it is well to smear wax or some sort of suitable water-proof dressing over the large cuts and scars on the bush, and moss, lichens etc. growing on the wood should be cleaned off. The prunings are best cut small and stacked in every other row, so leaving one row clear for subsequent forking or sowing the seed of nitrogenous cover crops.

Plucking. The plucked leaf should not be crushed, overwithered, or damaged in any way in the field, or in transit to the factory. Coolies pluck into baskets which they carry on their backs, and on no account should they press the leaf down in those baskets, or put leaf in their blankets or sarees which are close to the heat of their bodies. It is necessary therefore to weigh up the leaf at regular intervals and send it up to the factory. Weighments twice a day are enough in poor cropping periods, but three times and even four times are necessary in heavy cropping periods. The leaf is usually packed loosely into open work string bags for conveying to the factory. The leaf must not be crushed in the bags and it is best to put a uniform quantity in each bag, say 50 lbs. The bags are conveyed to the factory by the pluckers themselves from near-by fields, and by bullock carts, lorries, or ropeways from far away fields. Coarse leaf and stalk is picked out and thrown away before each weighment.

(To be continued).

Nitrogen Content of Sugarcane Juices and Colour of Cream Jaggery.

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Very early in the investigation of the process of cream jaggery manufacture (*Dept. of Agriculture, Bull.* 39, 1935), it was occasionally noticed that certain juices failed to yield cream jaggeries of superior colour and quality. These juices while becoming as colourless and clear as others after treatment with activated carbon, however developed a brownish colour towards the later stage of boiling. As the reason for the above abnormal behaviour was not well understood then, the quality of cream jaggery that may be expected from a particular juice could not be foretold with any degree of certainty and the demonstration of the new process was a fruitful source of anxiety to the men in charge ; but these adverse results were fortunately few and far between.

The above problem of colour production has been under investigation in the laboratory of the Government Agricultural Chemist for the past one year and as a result, certain tentative conclusions have been arrived at. Though the investigation has not been concluded, the results obtained so far are interesting enough and appear, therefore, to deserve a record.

As already mentioned, it was not every juice that could be made to yield high grade cream jaggery on carbon treatment. Among the refractory juices, were included juices from immature, diseased and lodged canes and it was argued that the factors operating in these cases were the high glucose content and the low purity of such juices. This conclusion appeared plausible as it is common knowledge that solutions containing reducing sugars, particularly invert sugar of levulose turn brown on heating and that the degree of browning is a function of the temperature and period of heating.

This explanation, however, appeared incomplete as certain juices though possessing low amounts of glucose and fairly high purity behaved, nevertheless, unsatisfactorily. P. O. J. 2878 was one such instance. It was grown in a garden land plot of the Central Farm, Coimbatore, Viz. in F. 59. The composition of the juice appeared by no means to be in defect as shown by the figures of analyses presented below.

Table showing the analyses of juice of P. O. J. 2878 grown in Field 59 of the Central Farm, Coimbatore.

Particulars	Dates			
	9—4—35.	21—3—35.	17—3—35.	1—3—35.
Brix.	19·80	19·00	20·36	20·38
Sucrose.	16·80	15·93	17·30	17·54
Glucose.	0·76	0·60	0·79	0·33
Coefficient of purity.	86·00	84·96	83·20	84·80

In spite of its good analysis, its behaviour during boiling was peculiar. Unlike the carbon-treated juices from other varieties, it developed considerable frothing during the course of concentration and subsequently the syrup turned brown and did not boil free. Further, the temperature of the boiling syrup could not be raised above 120°C without avoiding charring.

Co. 213 grown in the same plot, while not so good in quality of juice as P. O. J. 2878 exhibited the same undesirable characteristics during concentration for jaggery making.

Having found that the usual analyses of the juices viz. Brix, sucrose, glucose and purity did not furnish any clue towards an understanding of this problem, these juices were analysed in addition for total nitrogen.

As will be seen from the data presented below, the nitrogen content of the cane varieties grown in F. 59 was several times greater than that of the same varieties grown elsewhere.

Table showing variation in nitrogen content of juices of canes grown in different lands.

Variety.	*Age.*	*Where grown.*	*Total nitrogen.* %
Poovan.	11—12 months.	Central Farm, wet land.	0·020
"	"	Wet-lands, Perur, a village near Coimbatore.	0·024
"	"	" "	0·020
"	"	Wet-lands owned by a ryot near the Central Farm	0·020

Poovan.	11—12 months.	Perianayakanpalayam near Coimbatore.	0·027
,,	,,	F. 59 garden land, Central Farm.	0·113 Average of 6 results
Co. 213.	11—12 months.	Central Farm Wet lands.	0·026
	,,	F. 59 garden land, Central Farm.	0·133 Average of 6 results.
P. O. J. 2878	,,	Central Farm wet lands.	0·048
	,,	F. 59 garden land, Central Farm.	0·105 Average of 3 results
Co. 360.	,,	Central Farm Wet lands.	0·026
	,,	F. 59 garden land, Central Farm.	0·110

A more detailed analysis of the juice before and after treatment with activated carbon showed that more than 80% of the nitrogen was present in a soluble form, as may be seen from the data presented below.

Table showing nitrogen content of raw and filtered juices.
Co. 213 grown in F. 59 of the Central Farm, Coimbatore.

Date of analysis.	Particulars of treatment.	Brix. %	Sucrose. %	Glucose. %	Coefft. of purity.	Total N %	N x100 / Suc	N precipitated by Stutrer's reagent. %
12—3—36.	(a) Raw juice.	17·47	13·34	0·72	76·38	0·095	0·712	0·016
	(b) Treated with activated carbon and filtered.	21·32	17·96	0·93	84·25	0·099	0·551	0·005
14—3—36.	(a) Raw juice.	15·53	11·90	1·12	76·60	0·085	0·713	0·015
	(b) Treated with activated carbon and filtered.	17·83	14·70	1·46	79·23	0·095	0·641	0·004
	(c) Limed to excess—the excess lime removed with Co_2—then carbon treated and filtered.	18·21	14·10	1·50	77·50	0·097	0·688	0·004
17—3—36.	(a) Raw juice.	14·30	11·17	0·71	78·10	0·098	0·877	0·014
	(b) Treated with activated carbon and filtered.	16·50	12·94	0·82	78·40	0·100	0·773	0·004
20—3—36.	(a) Raw juice.	16·80	13·90	0·44	82·80	0·116	0·835	0·016
	(b) Treated with activated carbon and filtered.	30·3	24·43	1·20	80·60	0·185	0·757	0·004
27—3—36.	(a) Raw juice.	14·50	11·37	0·58	78·39	0·099	0·871	0·019
	(b) Treated with activated carbon and filtered.	15·49	12·25	0·67	78·09	0·105	0·857	0·004
	(c) Limed to excess—excess lime removed with Co_2, then treated with activated carbon, and filtered.	16·99	13·65	0·75	80·50	0·106	0·742	0·006

The data presented above suggest that the presence of an excessive amount of soluble nitrogenous substances is possibly responsible for the

browning of certain carbon-treated juices and this accounts for the inferior quality of cream jaggery. If this were so, the colour of cream jaggeries may be expected to bear a close relationship with their nitrogen contents and such was actually found to be the case as will be seen from the following results of analysis of several samples of cream jaggery.

Name of variety.	Colour of a 5% solution of the jaggery in units of the Lovibond tintometer for ½" cell. Yellow.	Red.	Total nitrogen on dry basis.	Glucose per cent on dry basis.
1. P. O. J. 2878	16·0	5·3	0·46	9·21
2. 247 B	9·8	2·5	0·15	12·00
3. Co. 351	8·8	1·8	0·11	12·91
4. Co. 356	8·6	2·0	0·11	5·04
5. E. K. 2	3·6	1·3	0·07	13·39
6. Co. 417	3·5	1·1	0·05	11·81
7. J. 247 (Ambur)	1·5	0·5	0·04	7·5
8. Fiji B (Palur A. R. S.)	0·5	0·2	0·02	13·90

The soluble nitrogen content appears thus to exert a more pronounced influence on the colour of final jaggery than the glucose percentage. An experiment in which Poovan cane obtained from a neighbouring ryot's field was cut into bottom and top halves, the two portions crushed, analysed and made into cream jaggeries separately pointed to the same conclusion.

Variety of cane.	Particulars.	Brix. %	Sucrose. %	Glucose. %	Purity.	Total N	Remarks on jaggery.
Poovan.	Bottom half.	19·76	18·03	0·53	91·24	0·019	Very light yellow colour: hard.
	Top half.	18·76	15·95	1·10	85·04	0·022	Slightly deeper in colour: hard.

A simultaneous presence of excessive amounts of nitrogen and glucose in sugarcane juice is rather disastrous as evidenced by the following results.

Variety.	Brix. %	Sucrose. %	Glucose. %	Purity coefft.	Total N.	Remarks on the quality of jaggery.
1. Co. 213	16·61	13·87	0·20	83·50	0·130	Fairly good colour and fairly hard.
2. do.	15·48	12·07	0·27	77·96	0·090	About the same as (1).
3. do.	12·27	8·73	0·93	71·15	0·093	Much more brown than (2) and much softer.
4. do.	12·79	9·15	1·10	71·53	0·107	Just inferior to 3.
5. do.	11·67	7·95	1·10	68·10	0·130	Almost indistinguishable from the ordinary jaggery.

The experiments detailed above lead to the question viz., what are the particular form or forms of the soluble nitrogen that are responsible for the colour development in jaggery ?

A preliminary examination of the juice for different nitrogen fractions showed that amino-acid nitrogen formed more than 50 per cent of the total soluble nitrogen.

It has been shown by Roxas (1916) that several pure aminoacids produced brown-coloured humin substances on boiling with carbohydrates in the presence of hydrochloric acid. Gortner and Holen (1927) emphasised the importance of aldehydes in the formation of humins during the acid hydrolysis of proteins. Joolyin and Marsh (1935) attributed the browning of orange juice, in part at least, to the amino-acid sugar reaction.

To determine how amino-acids behave under conditions obtaining in the process of jaggery making, viz., a high temperature and a slightly acid reaction, glycine and asparagine were boiled separately with various sugar solutions viz., sucrose, dextrose and levulose individually and in mixtures and the colours of the resulting products compared with the aid of the Lovibond tintometer as per details below. In another experiment, a jaggery solution was decolourised with paddy husk activated carbon and the decolourised solution was boiled with and without the addition of asparagin. The results are recorded below.

Table showing increased colour development in the presence of amino-acids.

	Particulars of experiment.	*Total colour units of the Lovibond* tintometer ½" cell (10% solution of the jaggery in water.)
1.	Jaggery made from a solution containing 12·0% of sucrose and 1·0% of glucose.	0·5
2.	—Do.— +0·5% of asparagin.	1·3
3.	Jaggery made from a solution containing 12·0% of sucrose and 1·0% levulose.	0·7
4.	Do. +0·5% of asparagin.	1·8
5.	A 5% jaggery solution decolorised by activated carbon treatment.	0·3
6.	250 cc. of the above boiled for two hours, cooled and made up to the original volume.	1·6
7.	No. 6 (above)+0·6 gms. of asparagin.	2·4
8.	Jaggery made from a solution containing 50 gms. of bazaar white sugar, 1·25 gms. of glucose, 1·25 gms. of levulose 1·0 gm. of amino acetic acid.	Reddish brown in colour.

It would appear from the above that the colour production under investigation is most probably due to the interaction between the amino-acids and the reducing sugars in the juice.

To obtain conclusive evidence on this point, it may be necessary to estimate not only the amino-acid content of different juices, but also the different fractions of nitrogen as well. Further investigation will, therefore, proceed on the lines just indicated.

Acknowledgement. We wish to acknowledge our indebtedness to Mr. P. V. Ramiah, M.A., B.Sc. (Edin.), Government Agricultural Chemist for

all the facilities afforded for the investigation and for his valuable criticism in the preparation of this article.

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A Scheme for Opening Agricultural Graduate Colonies By Government.

BY P. PARTHASARATHY, B. Sc. Ag.

The writer submits below a tentative scheme for the opening of graduate colonies designed to reduce unemployment. The scheme has been drawn up in consultation with experts.

I. The Government is requested to provide each individual with 20 acres of land on a 30 year lease. Land for this purpose is, I understand, now available at Settigunta near Kodur. This area is in close proximity to the Fruit Research Station at Kodur and expert advice from there can, therefore, be easily had.

II. It is also suggested that a central irrigation plant may be installed by the Government for purposes of irrigation. The initial cost of the installation may be borne by the Government but the maintenance of it may be undertaken by the lessees. The well would be available for use by the ryots of the neighbouring villages for drinking purposes, and as such, the initial cost on the same can be easily met with from the funds earmarked for the supply of drinking water for rural areas.

III. The area allotted to each individual under the scheme may be devoted to the following.

(a) 10 acres—under fruits.
(b) 1 acre —buildings, cattle-shed, threshing floor etc.
(c) ½ acre —vegetables.
(d) ½ acre —poultry and cattle.
(e) 7 acres—fodder and green crops.
(f) ½ acre —Nursery (citrus and mango grafts) with subsidiary home crafts like home-canning, spinning, rope-making, bee keeping etc. to be taken later.

Total. 20 acres.

IV. The amount required by the individual colonist would be as follows.

		Rs.
(a)	Buildings	1000
(b)	Levelling and fencing	500
(c)	Layout	200
(d)	Purchase of plants and implements (purchased from the Government nursery or raised by lessees)	500
(e)	First year working expenses	800
(f)	Miscellaneous farm requisites	250
	Total.	3250

The amount may be loaned by the Government to each lessee to be paid back annually during a period of 20 years with a small interest.

In case the lessees are in sufficient number, the purchase of implements and plants, erection of fencing and lay out of plots etc., can all be done on a co-operative basis; and similarly the produce may also be sold co-operatively.

V. Each lessee will be entitled to the entire produce from the area allotted to him for a period of 30 years, after which he will be allowed to purchase the farm outright, failing which it will pass into the hands of, the Government with all the immovable properties.

VI. The scheme will provide the following benefits.

1. Provide employment to agricultural graduates,
2. Make valuable and fully established gardens and farms available to the Government, free of cost after 30 years.
3. Demonstrate to the educated unemployed, a means of honourable living and the value of co-operative farming.
4. Show the possibilities of converting large uncultivable waste area into profitable land.
5. Provide an agency for the rapid dissemination of the research work carried out by the Government farms, especially on fruits.
6. Prove the value of specialised farming of fruits, vegetables and flowers; and stimulate the extension of areas under these; and also aid in the availability of fruits in plenty for the improvement of nutrition of the people.
7. Lead to the establishment of reliable seed farms, providing the cheapest method of raising and supplying seeds and plants of improved strains; thus correspondingly effect a considerable saving to the Government.

VII. The only special expenditure the Government is called upon to incur is on the cost of pumping plant. The loans granted to the lessees will be repaid and are, therefore, not a charge on the Government. Recovery of the loan is easy, because of the co-operative disposal of the produce, under the *aegis* of the Government. Although the Government is

requested to sanction the scheme for the benefit of the unemployed graduates, the former stand to gain enormously, because of the availability of large established farms free of cost after 30 years, and of the release of uncultivable wastes for profitable cultivation, thus indirectly increasing the revenue assessments and effecting a corresponding reduction in the cost of Government seed farms.

VIII. The control of the scheme can be effectively secured in the same manner as of 'fruit-grants' in the Punjab, according to which the conditions imposed are:—

a) The lessee should himself stay on the farm and run it, failing which, a competent man approved by the Director of Agriculture should manage the farm.

b) The area to be allotted under each fruit or crops, the method of orchard maintenance and the general fulfilment of the other conditions are subject to the approval of the Director of Agriculture and are to be examined by six months' inspection by the Government Fruit Specialist, whose report has to be forwarded to the Government through the Director of Agriculture.

c) Failure to fulfil any conditions will entail the cancellation of the grant without any compensation. In addition to this, the Co-operative Department may be held responsible for the sale of the produce and recovery of the loans in annual instalments.

IX. It is suggested that a beginning may be made with a dozen graduates in one tract. If the scheme succeeds, it may be extended to other districts as well.

X. An idea of the expenditure and income to the lessee from nurseries alone during the initial stages of the working of the scheme is presented below. After about 10 years the income from fruit gardens will be, by itself, sufficient to give a decent profit to the lessees after providing for the repayment of loans and other recurring expenditure.

Nursery scheme.

Citrus nursery for raising 20,000 budded plants.	Rs.	a.	p.
1. Purchase of 6000 sour oranges for seed extraction. ...	80	0	0
2. Extraction, selection of seed, at 4 annas for 250. ...	8	0	0
3. Preparation of ground, seed-beds etc., to accommodate about 30,000 seeds.	15	0	0
4. Sowing.	10	0	0
5. Wages of one watchman who will be watching, weeding of seed-beds, etc., for 6 months at Rs. 7/— per month. ...	42	0	0
6. Transplanting of about 20,000 selected seedlings.	50	0	0
7. Preparation of ground, nursery-beds, and pits for 20,000 seedlings at Rs. 3/— per acre for preparation of land, Rs. 50/— for making beds and Rs. 50/— for digging pits.	112	0	0

8.	Watching, weeding and watering for 2 years at Rs. 3/— per irrigation (for 24 irrigations), Rs. 6/— per weeding, (for 12 weedings) and Rs. 7/— per month for watchman.	572	0	0
9.	Selection of budwoods & budding at 100 per day. ...	112	0	0
10.	Cost of scion material.	48	0	0
11.	Tying materials and tools etc.	150	0	0
12.	Removal of stock sprouts and lopping.	90	0	0
13.	Miscellaneous.	200	0	0
	Total.	1,489	0	0

Receipts. By sale of 10,000 budded plants at 8 annas per plant.	Rs.	5,000	0	0
Deduct expenditure as per details above. ...	Rs.	1,500	0	0
Net profit	Rs.	3,500	0	0

Mango nursery for raising 600 grafts.

1.	Purchase of 1000 mango fruits of inferior seedling types. ...	15	0	0
2.	Extraction of stones.	2	8	0
3.	Preparation of beds.	5	0	0
4.	Sowing.	1	0	0
5.	One watchman for both citrus & mango nurseries. ...	—		
6.	Weeding and watching for one year.	27	0	0
7.	Transplanting of 600 seedlings into pots.	3	0	0
8.	Cost of pots, composts, crocks etc.	15	0	0
9.	Grafting expenses for 600 plants including tying. ...	15	0	0
10.	Cost of scions.	12	0	0
11.	Separation of grafts.	1	0	0
12.	Watering and watch of grafts in pots till separation (5 months)	45	0	0
13.	do. for 3 months after separation. ...	21	0	0
14.	Miscellaneous.	12	8	0
	Total.	175	0	0
	Revenue by sale of 600 grafts at 6 annas each.	225	0	0
	Net profit.	50	0	0

Hence the net profit for preparing 20,000 grafts is Rs. 1,500.

Seasonal Variations in the Flight Activities of Bees.

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Introduction. That the flight activities of bees is to a large extent influenced by environmental factors is well recognized. But how far variations exist as between season and season or between hive and hive is much less known in India. In the present investigation the monthly variations of flight activities were studied.

Material and Methods. To enable the comparison of flight activities of bees some index of such activities is essential. The ideal method of measuring the flight activities will be to have a counting device which would indicate the number of bees that enter a hive or leave the hive on a given day. But with such a device it would not be possible to count separately bees bringing pollen loads and nectar loads. The flight activity in a colony is a continuous process commencing from sunrise to sunset, it being affected only by environmental factors. If during definite intervals the bees arriving at the hive during a period of, say, one minute, are counted, this count may be taken as a representative sample of the activity during such intervals in each colony and may form the basis of comparison. Ratnam (1938) counted the incoming bees during a period of one minute, at intervals of fifteen minutes. In the present study the same method has been followed, but the counts were made at hourly intervals; and separate counts were made of bees arriving at the hive with pollen as well as those without it.

According to Woodrow (1932) " the counts of bees leaving the hive is a better index to immediate effect of external conditions ", since between the time a bee leaves the hive and its return, there is an appreciable time interval, during which time environmental conditions might have undergone a change. But here again separate counts of nectar gatherers and pollen carriers cannot be made, and so Woodrow's method has not been followed in the present study.

Three hives of *Apis indica* of approximately equal strength were selected for the present study. The counts of incoming bees were made at hourly intervals during fortnightly periods commencing from the last week of August 1937 to end of August 1938, thus making one full year. It was not convenient to record counts in the first week of April 1938. Readings were taken, as far as possible, on two successive days. Out of 23 readings recorded, 16 are the average of two successive days. In other cases only a single day's readings are considered. The readings recorded on the 16 pairs of successive days are very highly correlated, the coefficients of correlation amounting to $0{\cdot}8174 \pm 0{\cdot}05598$, $0{\cdot}8387 \pm 0{\cdot}05001$, and $0{\cdot}9393 \pm 0{\cdot}01987$ in the case of each of the hives A, B, and C respectively. This shows that reliance can, without doubt, be placed on those

readings recorded on single days as well. Two individuals were at work simultaneously for counting pollen gatherers and nectar gatherers respectively, and they changed their duties frequently with a view to obviate errors, if any, due to personal factors.

Variations in General Seasonal Trends. The index of flight activity for each day is taken as the total of the counts made at hourly intervals of bees returning to the hive per minute with pollen or without it. Such readings were taken from 6 a.m. to 7 p.m. Water carriers may perhaps be included in the counts for nectar gatherers; but that would not materially affect the flight index which is merely used for comparing the activities of three hives on different days. In Graph I these indices of flight activity in respect of pollen and nectar are plotted. The most remarkable feature of the graphs is their identical trends for all the three hives. In colony C a swarm issued a few days prior to 1st January 1938, and it was also rendered queenless between this date and 13th January 1938, so that the reproductive activity of the colony has been interrupted. After 1st January 1938, therefore, the conditions of this colony cannot be deemed to be comparable with the others. The similarity of the trends of the graphs can only be due to the fact that under identical environmental conditions bees of the same type work at the same rate. The graphs for nectar activity show remarkable peaks in the months of November to February, and April to June, when pasturage conditions are favourable in the locality as reported by Ratnam (1938 a.). The graphs for pollen do not show very high peaks because the number of bees engaged in collecting pollen is relatively much less. Here again the graphs for each one of the hives show similarity of trends. They indicate that a maximum field force is at work for collecting both pollen and nectar. If this were not so one graph may reach a peak at one time when another is not so, and large variations would have been noticed.

Proportion of bees engaged in pollen gathering and nectar collecting. In Table I the index of flight activities during the various seasons is furnished. This is the material on which Graph I has been constructed. Since a swarm issued from colony C before 1st January 1938 and since the queen found in the hive after this date was missing before 13th January 1938 and had to be re-queened, the conditions in this colony are not, as has been stated earlier, strictly comparable with those of colony A or B. Indeed there is a remarkable fall in the activity of colony C particularly in the readings taken on and after 27th February 1938.

In the last three columns of Table I, the percentage of bees gathering pollen out of the total bees engaged in field work on any given day has been indicated. It is seen that in no case more than 40 per cent of the bees is engaged in pollen gathering. In about 18 readings, out of a total of 23, less than 20 per cent of the bees is engaged for this purpose. The percentage of bees gathering pollen on any given day in all the hives, appears to compare very favourably within the limits of the error that is obviously inescapable in a study of the present kind.

Over four times as many bees as are engaged during seasons of dull pollen activity are at work when there is an abundance of pollen. Thus the index of flights for pollen gathering on 29th January 1938 (a dull day) is 25 in colony A, but this is as much as 119 on 18th December 1937 (a busy day). On 20th November 1937 also there is a lull in pollen gathering and in colony B the index recorded on this day is only $\frac{1}{6}$th of that of the busiest day, viz., 18th December 1937. Similarly also in the case of nectar gathering, the readings taken on 1st January 1938 (the peak of activity) is nearly $4\frac{1}{2}$ times those taken on 29th August 1937 (a lull in nectar gathering). Whether these variations are merely due to the proximity of pasturage when bees can make a larger number of trips per day, or whether they are due to a larger number of field bees available in each colony on account of increased reproductive activity in the hive is hard to state definitely with the data available at present. Further work is necessary.

TABLE I. Index of Flight Activities.

Date of observation.	Hive A			Hive B			Hive C			Percentage of bees collecting pollen.			Remarks.
	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	A	B	C	
29—8—37	63	121	184	57	110	167	67	102	169	34	34	40	
18—9—37 and 19—9—37	60	130	190	54	105	159	65	153	218	31	34	30	
3—10—37 and 4—10—37	97	138	235	55	92	147	98	147	245	41	38	40	
22—10—37 and 23—10—37	32	173	205	33	190	223	23	183	206	15	15	18	
7—11—37	80	397	477	44	274	318	64	229	293	17	14	22	
20—11—37	25	380	405	15	274	289	20	342	362	6	5	6	Cold morning. Rain during previous night.
5—12—37	95	489	584	93	389	482	97	387	484	16	19	20	
18—12—37 and 19—12—37	119	481	600	95	420	515	102	372	474	20	18	22	
1—1—38 and 2—1—38	80	513	593	65	490	555	96	513	609	14	12	16	Swarm issued from colony C.
13—1—38 and 14—1—38	34	381	415	44	450	494	54	493	547	9	9	10	Queen missing in colony C and it was requeened.
29—1—38 and 30—1—38	25	435	460	25	460	485	35	580	615	5	5	5	
12—2—38 and 13—2—38	40	395	435	30	335	365	30	325	355	9	8	9	
27—2—38 and 28—2—38	75	320	395	35	230	265	25	180	205	11	13	12	
19—3—38 and 20—3—38	90	237	327	82	279	361	83	211	294	27	23	28	

Readings are not available for first week of April 1938.

Date of observation.	Hive A			Hive B			Hive C			Percentage of bees collecting pollen.			Remarks.
	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	A	B	C	
23—4—38 and 24—4—38	31	344	375	28	377	405	21	234	255	8	7	8	
7—5—38 and 8—5—38	25	430	455	31	442	473	11	239	250	6	7	4	
21—5—38 and 22—5—38	75	427	501	77	440	517	25	257	282	15	15	9	
9—6—38	56	225	281	49	323	372	28	170	198	20	13	14	
18—6—38	30	186	216	29	203	232	30	145	175	14	13	17	
8—7—38	38	58	96	31	58	89	37	73	110	40	35	34	Very cloudy weather.
23—7—38 and 24—7—38	48	242	290	46	271	317	32	172	204	17	15	16	
6—8—38 and 7—8—38	30	176	206	40	171	211	41	183	224	17	19	18	
20—8—38 and 21—8—38	31	283	314	30	283	313	33	200	233	10	9	14	Rain received on 21—8—38 afternoon.

Monthly variations. (*a*) *Pollen.* Pollen activity shows a remarkable increase between the end of November and end of December. It is during this period that there is considerable reproductive activity. A large army of field workers will be released by about December and the strength will be maintained at least till about the end of January. This is actually the case and we find in the graphs for nectar activity a remarkable and sustained peak during these months. The next season for pollen is during the month of March which is the forerunner of the honey crop of April.

In Table II the distribution of activity in percentages in respect of pollen activity during the various parts of the day is furnished. For the purposes of interpretation, it appears to be convenient to divide the day into three periods, viz., morning period from 6 to 10 a. m.; midday period from 11 a. m. to 2 p. m.; and afternoon period from 3 to 6 p. m. Although the number of readings that comprise each one of these periods is uneven, the number of full hours during which bees have been at work at each one of these periods does not vary considerably. In the absence of a better criterion for studying the distribution of flight activities during the day, this classification has been followed.

The total index for a day is taken as 100 and the distribution of activity during the three periods has been furnished in Table II. The absence of any material pollen activity after 2 p. m., is the most important feature of the Table. Of the 23 readings, only in one case 66 per cent. of the bees are seen to collect pollen between 3 and 6 p. m., and in three other cases about 33 to 40 per cent. In all other cases, less than 26 per cent. of the bees are active in collecting pollen. More than half of the readings show an activity ranging from 0 to 10 per cent. It is, therefore, reasonable to conclude that bees are not busy collecting pollen after 2 p. m. These observations are in conformity with those of Ratnam (1938a).

In respect of the distribution of pollen activity in the morning and midday periods, the year can be divided into two groups. From November to March, generally, over 50 per cent. of the bees are busy collecting pollen in the midday period. And in April to October bees are more active in the mornings.

The readings taken on 3rd and 4th October 1937 appear to be abnormal. This was perhaps due to some environmental factor other than pasturage conditions. What it exactly was has not been ascertained.

TABLE II. Distribution of flight activity during the day.

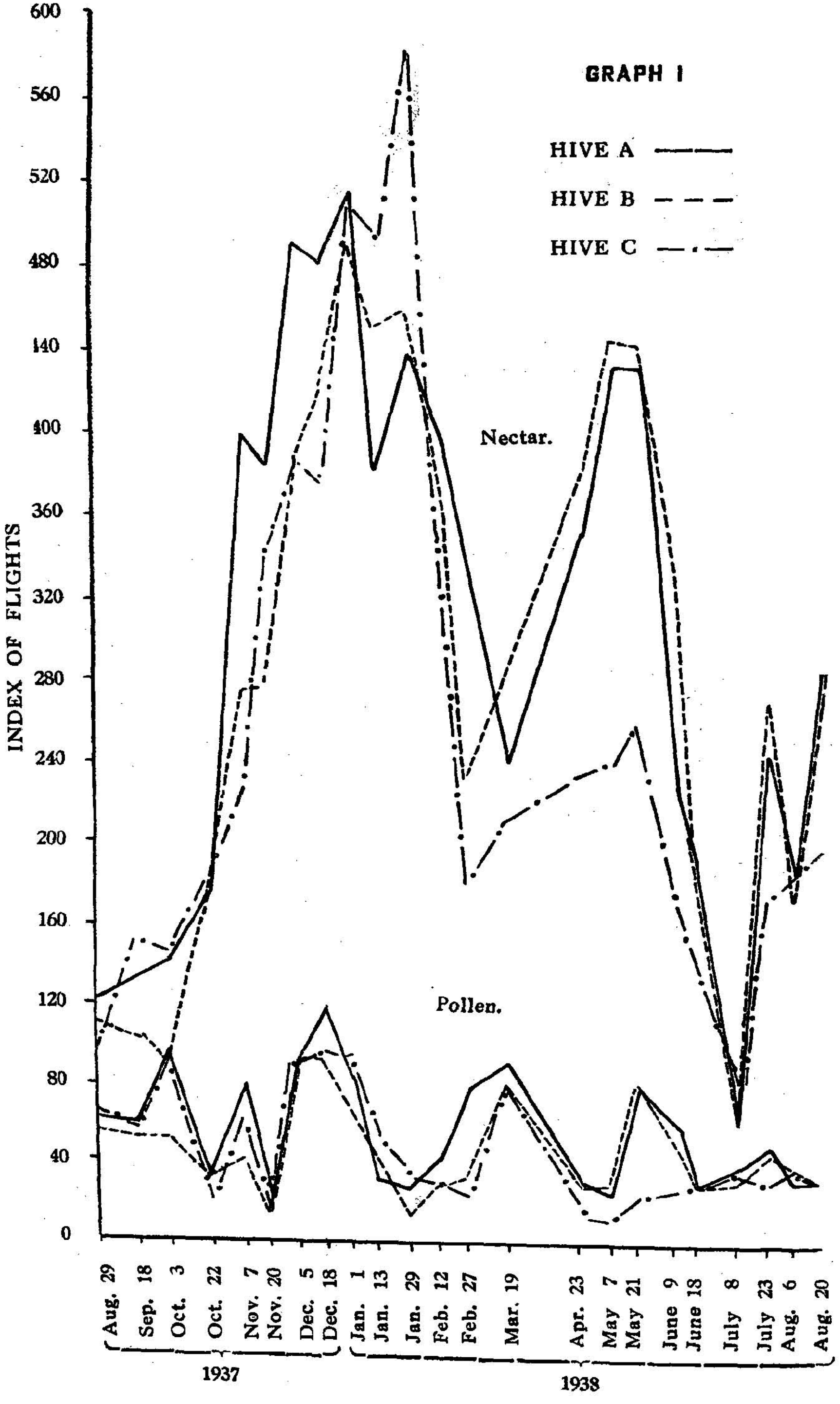
Hive A. (In percentages).

Date of observation.	Pollen gathering			Nectar gathering		
	6 a. m. to 10 a. m.	11 a. m. to 2 p. m.	3 p. m. to 6 p. m.	6 a. m. to 10 a. m.	11 a. m. to 2 p. m.	3 p. m. to 6 p. m.
29-8-37	67	33	...	28	53	19
18-9-37 and 19-9-37	88	12	...	39	46	15
3-10-37 and 4-10-37	20	14	66	25	25	50
22-10-37 and 23-10-37	97	3	...	72	16	12
7-11-37	50	35	15	37	43	20
20-11-37	4	92	4	36	51	13
5-12-37	64	32	4	23	57	20
18-12-37 and 19-12-37	31	54	15	20	55	25
1-1-38 and 2-1-38	67	24	9	17	58	25
13-1-38 and 14-1-38	12	50	38	12	63	25
29-1-38 and 30-1-38	16	48	36	12	58	30
12-2-38 and 13-2-38	40	52	8	21	48	31
27-2-38 and 28-2-38	36	47	17	22	31	47
19-3-38 and 20-3-38	29	70	1	49	33	18
Readings are not available for first week of April 1938.						
23-4-38 and 24-4-38	71	29	...	49	26	25
7-5-38 and 8-5-38	92	4	4	56	21	23
21-5-38 and 22-5-38	100	...	...	68	14	18
9-6-38	75	14	11	60	17	23
18-6-38	45	20	35	51	28	21
8-7-38	55	37	8	42	48	10
23-7-38 and 24-7-38	61	31	8	47	38	15
6-8-38 and 7-8-38	50	47	3	19	27	54
20-8-38 and 21 8-38	42	32	26	10	41	49

(*b*) *Nectar*. In Table II the distribution of nectar gathering during the day in percentages is given. As in the case of pollen collecting, bees seem to be less active in gathering nectar in the afternoons after 3 p. m. Of the 23 readings available as many as 17 readings show that 25 per cent. and less of bees are busy in gathering nectar after 3 p. m. Here again the readings recorded on 3rd October 1937 and 4th October 1937 appear to be abnormal.

In November to February bees appear to be busy at the midday period. During these months the morning activity appears to be even less than the afternoon activity. During May and June bees are most busy in gathering

VARIATIONS IN FLIGHT ACTIVITIES



nectar in the mornings. The activity is at its lowest during the midday period and slightly higher in the afternoons.

Generally it appears that the morning activity and midday activity are complimentary to each other. That is on days when the morning activity is high, the midday activity is low and *vice versa*.

The following variations in the average monthly nectar gathering activity are noticed :—

Trend of activity.	*Month.*
1. High midday activity	December, January, February
2. High forenoon activity falling only slowly as the day advances	November, April
3. High early morning activity with a steep fall after about 7 a. m.	May
4. High activity twice in the day at 6 a m. and 6 p. m. with a lull during the midday	October
5. Peaks of activity thrice in the day :— (a) With the highest activity during midday	March
(b) With the highest activity during forenoon	June, July, September
(c) With the highest activity during afternoon	August

Discussion. The present investigation was undertaken to study seasonal variations in flight activity of bees and it has indicated the existence of wide fluctuations in their activities. In the two honey flow seasons the distribution of activity differs fundamentally. During November—January season the bees are more active during the midday but in April to June season the bees are extremely active during the forenoon only. The months of November and April mark the transition to very favourable pasturage conditions and the activities during these months are strikingly alike.

Practical bee-keepers recognize the supreme importance of maintaining strong colonies not only with a view to combat bee diseases and enemies but also with a view to obtaining the maximum honey crop during the honey flow seasons. For instance, during seasons of paucity of pollen, the reproductive activity in the hive is at its lowest ebb, and each colony dwindles very much in strength. During these unfavourable seasons the practical bee-keeper removes the supers and even a few brood combs, if necessary, so as to check ravages due especially to the wax moth. When there is a prospect of a nectar flow about a month or so ahead, the bee keeper tries to increase the strength of his colonies by artificial feeding and tries all his resources to prevent swarming at a later stage. Whether a graph of the type represented in Graph I can indicate impending changes in the environmental conditions so as to enable the bee-keeper to forestall requirements in respect of manipulations requires further study spread over a number of years.

As between hive and hive there is hardly any difference and where the reproductive activity within the hive is proceeding uninterrupted, the variations in flight activities in the respective hives are strictly comparable.

Summary and Conclusions. This paper embodies the results of a study relating to seasonal variation in flight activities of bees during the course of the twelve months of the year. Counts of bees arriving at the hive with or without pollen during a period of one minute taken at hourly intervals of a day and at intervals of a fortnight were made. Three hives were compared and no differences were noticed in the trends of activity in them. The activities during the day vary considerably in the various seasons. There are two honey flow seasons during the year during which the distribution of flight activities differs fundamentally. In November to January, midday activity is more pronounced but in April to June, bees are remarkably active in the forenoons. Variations of flight activities appear to indicate variations in pasturage conditions and so a knowledge of the former is, subject to further confirmation, considered as a satisfactory aid for determining practical manipulations required by the bee-keeper. Percentage of bees gathering pollen in each of the hives compares favourably with one another on any given day. The number of field trips made for pollen collecting on any given day is less than 20 per cent. of the total trips made. In seasons of high activity the total number of trips made exceeds four times those made in dull seasons.

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SELECTED ARTICLE

The storage of Tropical Fruits.

Of the number of attractive fruits native to tropical and sub-tropical regions, only a few have yet attained to commercial importance. Relative to citrus and bananas, all other tropical fruits, though their production could be greatly extended, occupy a very minor place on temperate markets and for the most part are only retailed in small quantities and at high prices for the delectation of connoisseurs.

In addition to the tropical fruits occasionally offered on temperate markets there still remains a very considerable number of exotic fruits whose overseas transport has not yet been attempted, or been taken beyond the preliminary experimental stages. For this seeming neglect many reasons can be advanced, including demand (which must first be created by an extensive advertising campaign), competition with other fruits chiefly temperate, difficulties of consistent production, the need for special packing, shipping and cold storage facilities and lastly, the high degree of wastage inseparable from the handling of delicate tropical fruits. With a few notable exceptions, in fact, the transport of tropical fruits is still in its infancy. With the improvement of transport facilities it may be anticipated that this situation will to some extent be modified and that, in time, an increased variety of properly ripened exotic fruits will regularly be offered on temperate markets. Accordingly a wide and interesting

field of scientific inquiry still awaits appropriate investigation. Relevant aspects, on which a brief annotation will be attempted here, include (i) horticultural relationships, (ii) harvesting maturity, (iii) pre-storage treatment, (iv) cold storage requirements, (v) post-storage and ripening treatments, and (vi) wastage.

1. **Horticultural Relationships.** Environmental factors, seasonal conditions, and plantation sanitation are important in determining quality, keeping quality in storage and wastage (see below). The selection of varieties adapted to particular environments, and acceptable on distant markets, is of first importance. Some examples, illustrating these several points may be cited; avocados which possess a high fat content when grown under dry Californian conditions have a considerably diminished content when grown under humid conditions in Florida or the West Indies: the Peter's mango, which grows well under Jamaica conditions, cannot be grown commercially in Trinidad because of excessive rotting during storage; the Congo variety of banana, which is cultivated in the French Antilles and can be disposed of to advantage in French markets, is unacceptable on British or American markets.

Standardization and conservation of desirable types have also important economic aspects. For example, in establishing grapefruit orchards, bud-wood should only be selected from trees known to possess consistently the desired degree of seedlessness. In fruits such as the papaw in which seedling types show great variability and where no method of vegetative propagation is known, the resulting absence of standardization is a serious obstacle in the way of developing an export industry.

2. **Harvesting Maturity.** The question of harvesting maturity is specific to each fruit, and criteria, not infrequently of an arbitary nature, have to be employed. To allow for the progress of ripening during transport and distribution, tropical fruits, as a rule, are picked somewhat immature. Thus the banana is reaped when it is still quite immature and green, at stages described as three quarters full, heavy three quarters full, or full, according to the distance of the market for which it is intended. The necessity for harvesting fruits somewhat immature adds to the problems of the physiologist, for whereas in some fruits the onset of ripening is indicated by well marked colour changes, in many others no colour change is apparent, and other means have to be devised in order that fruit shall be harvested at a constant maturity. With grapefruit and oranges biochemical tests based on the percentage of total solid, and on the ratio of sugar to acid have of necessity been adopted, particularly where early season's fruit is being handled. The ratios which have been found suitable in some countries, however, have not always proved rational or acceptable in others, and additional local criteria have had to be devised. In different varieties of mango, it has been found convenient to use a morphological criterion of maturity, the relationship between the stem insertion and the degree of development of the shoulders of the fruit (where growth is localized) being used for this purpose: otherwise, in many of the best commerical varieties colour changes associated with ripening afford very little assistance indeed. Again, in green varieties of avocado, no good criterion of commercial harvesting maturity, other than a tentative ratio of fat content to the fresh weight, has so far been ascertained. In fruits such as the papaw, to illustrate another aspect of this problem, it has been found that unless fruits show some evidence of yellow (ripening) colour on harvesting, they will not ripen properly later. In tomatoes it is known that fruits picked when they show some pink coloration ripen to a product of superior quality than do those picked full grown but green.

3. **Pre-Storage Treatment.** As a rule, in handling tropical fruits, it is desirable that the time between reaping and placing them in cold storage should

be curtailed to the minimum, as it is during the period of exposure to tropical tempar.atures that fungi would make a rapid initial penetration which markedly affects the subsequent progress of rotting. Again, in fruits harvested just before the onset of ripening, undue exposure to high temperatures tends to accelerate maturation processes, thereby curtailing the anticipated storage life. While quick handling is usually desirable there are circumstances in which some delay is advisable. Thus with citrus fruits which have been picked in a highly turgid condition, it is sometimes advisable that a quailing or curing period should be allowed to minimize the tendency to superficial bruising and the concomitant fungal wastage.

In some industries, e. g., citrus, fruits may be subjected to routine washing, disinfecting, ethylene ripening and machine grading before being packed. Each process requires critical examination in respect of its physiological or pathological effect on the fruit, such problems as desiccation bruising and wastage being relevant to the case in point. Disinfectant treatments, for example, should only be used when the precise nature of the several rot-producing organisms has been clearly ascertained, since instances are known where the most important pathogens, being already present within the tissue as latent infections, or established as wound infections, are aggravated and not arrested or eliminated by the treatments applied.

4. **Cold Storage.** Although in some instances fruits may be shipped during comparatively long voyages without refrigeration, as a rule, particularly where delicate tropical fruits are concerned, cold storage is essential. Well-equipped refrigerated shipping is in fact the fundamental factor in the overseas transport of perishable tropical produce, refrigeration by the air blast system being now considered indispensable for the proper handling of fruit. For the major export commodities, such as bananas and citrus, considerable information on the required storage temperatures is now available, but for many others only fragmentary and inconclusive data have been obtained. In selecting a temperature for the overseas transport of fruits two factors are principally involved: (i) the temperature must be sufficiently low adequately to control or arrest ripening and the growth of pathogens, but (ii) it must not be so low as to cause physiological injury or "chilling" to the fruit. Fruits which have been chilled in transit not only fail to ripen properly, with concomitant loss of flavour, but they are also subject to increased fungal wastage The onset of chilling, in a number of fruits, is known to coincide with the onset of ripening — a critical phase in the life of fruits. Superficial chilling injury tends to be exaggerated where fruits are also subject to desiccation, whereas at high relative humidities such injuries may be more or less completely masked. Once the precise storage temperature, i. e., just above the critical temperature for chilling, has been ascertained, fruits may be cooled as quickly as possible by delivering cold air at that temperature, without danger of chilling. Where this information is available pre-cooling may be used to advantage.

The storage temperatures required by different tropical fruits cover a considerable range, which is, however, more in the nature of "cool" storage than "cold" storage. Thus, for fruit grown under West Indian conditions, the following temperatures have been determined: Limes, grapefruit and oranges, 45 F; tomatoes, 45—47F: avocados, 45F; mangoes, 47·5F; Lacatan Congo, Giant Governor bananas, 58F.; papaws 60F. In so far as chilling injury is in part a function of the duration of storage, fruits undergoing prolonged storage may require a modification in the upward direction, of the temperatures cited. The tomato may be cited as an example where fruits grown under different conditions may require considerably different storage temperatures. The banana

illustrates the fact that different varieties may show considerable differences in their tolerance of low temperatures. The range of temperatures required by different tropical fruits introduces additional difficulties in the matter of shipping, since, as a rule, even modern refrigerated ships are not provided with a number of small compartments in which small consignments can be accommodated each at its own special temperature.

The control of humidity, chiefly the maintenance of high humidities, is also important in the proper handling of fruits grown under moist tropical conditions. Instances are known (e. g., limes and grapefruit) where fruit may become unsightly and unmarketable, not because of the onset of fungal wastage, but on account of excessive desiccation. This aspect of the physiology of fruit in storage has so far received insufficient attention: with the advancement of special knowledge of the water-relations of fruit in storage considerable improvement in the technique of handling fruit should become a practical possibility.

5. **Post-Storage and Ripening**. When tropical fruits are removed from cold storage to higher temperatures, ripening takes place rapidly, and serious wastage may soon be sustained. To a considerable extent the latter undesirable feature could be overcome by hooding the fruit at a suitable temperature until required for actual consumption. In countries where refrigeration has been more or less thoroughly domesticated, such special post-transport treatment is feasible and is, in fact, a workable proposition. In many countries, however, refrigeration, whether in warehouse or small stores, is still regarded as an unwarranted and additional expense; until some modification is made in this point of view considerable wastage must be expected during the retailing of delicate tropical fruits. In brief, the outlook for exotic fruits on distant markets will be determined among other factors, by the extent to which the use of refrigeration becomes domesticated.

Some fruits, in particular the banana, undergo special ripening treatment, involving temperature and humidity control on being removed from the ships' holds: the improvement of ripening technique opens up a wide and useful field for physiological work.

6. **Wastage.** If tropical fruits are allowed to remain at high temperature for any considerable time after harvesting, the onset of wastage tends to be rapid. Hence recommendations for the improvement of shipments stress the importance of good organization to permit of expeditious handling after harvesting and rapid cooling to the approved storage temperature. Wastage in most instances may be attributed to the activities of two major types of pathogenic fungi: (i) wound parasites which enter through the numerous wound and abrasions sustained during handling; and (ii) those which are established as latent or dormant infections during the earlier stages of development of the fruit, and which do not become evident until a certain stage in senescence has been reached. Knowledge of the precise behaviour of the several organisms involved is essential in formulating rational measures of disease control. Thus where wastage is due to the development of latent infections, it is evident that control measures must be applied in the field (i. e. by protecting the young fruits from infection), and that questions of environment and plantation sanitation must be given consideration.

Summary. With a few notable exceptions, the overseas transport of tropical fruits is still comparatively undeveloped. The many factors involved in creating an export industry based on the production and handling of delicate fruits notoriously subject to wastage are briefly discussed and illustrated by reference to bananas, citrus, avocados, mangoes and papaws.

(*The Tropical Agriculturist*, Vol. XCI, December 1938, No. 6.)

EXTRACTS

CASTOR OIL

The United States is easily the largest importer of Castor Beans and Oil, the bulk of her imports coming from British India. U. S. imports of Castor Beans alone for the year 1934-36 are as follows:—

Year.	Quantity thousands of lbs.	Total value thousands of $	Value per thousand lbs.
1934	92,840	1,738	18·72
1935	77,049	1,702	22·09
1936	164,077	3,621	22·07

Of the 164,077 thousand lbs. imported in 1936, the bulk came from British India. Other important producing countries are China, Japan, Brazil, Venezuela, and the Argentine.

Many of the producing countries manufacture their own oil, but it is claimed that the best extraction is at present done in the U. S. A.

Owing to the high oil content of the seed, Castor Oil extraction by pressure requires rather specialised machinery and solvent extraction methods are now the most popular.

The Castor Bean of commerce consists of (1) a soft non-fibrous kernel containing approx. 62·9% of oil (2) a thin brittle seed coat, easily cracked or chipped in handling, containing approx. 10% oil.

In handling the beans extreme care must be taken to prevent breaking of this seed coat and the elimination of such broken beans from the samples to be exported, as broken beans rapidly deteriorate, the oil being converted to glycerine and free fatty acid which causes the production of a highly coloured acid oil during the process of manufacture. In commercial practice an extraction of about 36% oil is obtained.

Uses of Oil. Owing to its very low freezing point (18°C) Castor Oil is used to a large extent for the lubrication of aeroplane engines. It also has the following advantages over mineral oils:—

a) Greater lubricating power.
b) Does not lose viscosity at high temperatures as quickly as mineral oils.
c) More penetrating, and
d) When mixed with gasolene, as happens during the lubrication of gas engines, it retains a higher viscosity than mineral oils.

Castor oil is also used for the lubrication of automobile engines. It is usually mixed with mineral oils, which are much improved thereby.

Mixed with animal fats in varying proportion it is also used for making various grades of grease for light and heavy lubricating work.

The uses of castor oil in medicine is well known.

Other uses of Castor Oil include:—

1) in manufacture of artificial leather.
2) leather lubrication.
3) assists penetration of tannin into leather.
4) production of Turkey Red dye.
5) manufacture of linoleum,
6) various uses in rubber industry.
7) manufacture of artificial skin preparations manufacture of transparent soap.

9) manufacture of shellac.
10) manufacture of Typewriter ink.
11) manufacture of Flypaper.

The number of industrial uses of castor oil is undoubtedly expanding.

During the Great War the Allies devoted much attention to increasing the production of castor oil; as a result, on the cessation of hostilities, the world markets were to a great extent overstocked with this commodity. With the world again devoting itself to a policy of re-armament and the imminent threat of a major war staring us in the face, it is not unlikely that the demand for castor oil will soon be on the increase. *H. C. Cameron in the Journal of the Jamaica Agricultural Society* (1939), p. 25—26.

Gleanings.

Thorough Cultivation of Soil. In most countries, and especially in Great Britain, farmers have a traditional belief in the necessity and virtue of thorough cultivation. Although it is self-evident that some cultivation is needed to secure a satisfactory tilth, it is not certain that additional and deeper workings of the soil are as valuable as has been generally thought. At the present day when cultivation is one of the heaviest expenses on the farm, the question clearly needs reconsideration, and Dr. B. A. Keen has recently given some interesting results of investigations on the subject (*J. Min. Agric.*, 45, 645; 1938). Experiments carried out over a number of years on heavy land showed that deep ploughing or subsoiling was of little or no benefit to a sugar beet crop, while extra ploughings, though they produced some small increase in the yield of the potatoes and sugar beet, were also uneconomic operations. Similarly, intensive inter-row cultivation of root crops, hitherto regarded as desirable, proved a waste of labour on both heavy and light land. The practice of rolling and harrowing cereals, on the other hand, was supported by experimental evidence. Rotary cultivation received special attention, comparison being made between plots prepared by the plough, the grubber and the rototiller. Germination tended to be quicker on the loose seed bed from the rototiller, but subsequent growth and yield were very similar on all three sets of plots. If time presses, therefore, the quicker and cheaper process of grubbing can safely be substituted for ploughing, but the practice should not be continued for several years in succession, as weeds are liable to increase rapidly. The conclusion that, beyond a certain minimum, cultivation has little influence on crop yield has also been reached from experiments carried out on different soil and under different climatic conditions, but still further work is needed to determine if the results are of general application, or are typical of certain types of soil and climate only. (*Nature*, Vol. 143, No. 3610.)

All Flesh is Grass. It is remarkable how important grass is to us all. When we come to think of it, grass is the foundation of both human and animal life. The meat eating animals certainly don't feed on grass, but without grass to fatten other animals they would die. Grass is the basis of all life on the land. It is the basis of all Agriculture. Without grass man would soon perish from the earth. Looked at in that light, pasture renovation and management becomes really an expression of a natural instinct of self-preservation. (*Queensland Agri. Journal*, Vol. LI. Part 3.)

Moving with the times. To-day brains and education were never more needed to run a farm successfully. A knowledge of science—that is, the science that any level-headed farmer can acquire—ought if directed properly, to put in enhanced value on our practical work. A little more study of the scientific side

would help to lighten the drudgery now so much associated with the lives of many producers. Farm science with a reasonable amount of practical knowledge is the strongest sort of combination that could be applied to the task of getting the most and best out of a farm. Of course, we all know the farmer who says that he hasn't got time to waste on reading up what is new. But it is a good policy, and it pays to find out what other farmers are doing and what research workers are finding out, and what general progress is being made in the industry. Farmers, like everyone else, can't afford to stay in one place. We have to move with the times and make use of the latest knowledge and gadgets if we are to get what we should get from our land. (*Queensland Agri. Journal* Vol. LI. Part 3.)

Rubbered Wool Yarns. The Wool Industries Research Association in its annual reports for 1936—1937 makes mention of successful experiments in the rubber treatment of wool yarns. It is possible, according to the association's report, to rubberise wool yarns in hank form with a suitably prepared latex without any matting. The wool can be dyed either before or after treatment, and the colour may be applied, if so desired, in the latex itself. The process is expected to give favourable results in the manufacture of strong yarns with little twists, and of felt. It is also recommended for special purposes, such as water-resistant or mothproof fabrics :— (*Tropical Agriculture,* Vol. XVI, No. 4)

Jute Substitutes. According to the information contained in the Bulletins of the Indian Central Jute Committee, a new Italian company has been floated in Ethiopia with the object of cultivating fibres which can serve as substitutes for jute in East Africa.

The Department of Agriculture South Africa, has been experimenting for some years with Brown Hemp, or *Hibiscus canabinus*, indigenous to South Africa, and has come to the conclusion that this annual, which often reaches a height of seven feet, can be cultivated on a wide scale and used as a substitute for jute. *Hibiscus bifurcatus*, a native plant of Brazil, has been found to be useful as a substitute for jute in that country.

A new type of heavy paper suitable for the manufacture of sacks has been made by Dr. Tunji Torii, Chief Chemist of the Japanese Bag Company, Tokyo. The product is reported to be better than hemp or leather, in resisting water and sand, and it is claimed that its strength increases when left in water for prolonged periods. In Manchukuo, Kenaf is being cultivated on a large scale with a view to substituting it eventually for jute.

In the Belgian Congo, *Urena Lobata* and *Punga* fibres, which were introduced in 1930, have achieved a position of relative importance as substitutes for jute.

Rosella is being cultivated in Java, and Rosella bags are being extensively employed in the sugar trade in place of jute bags. It is expected that unless unforeseen circumstances arise, Java will become self-supporting in three to four years at least so far as sugar bags are concerned. (*Tropical Agriculture,* Vol. XVI. No. 4.)

Absorption of growth promoting substances by cuttings. About two years ago a batch of leafless cuttings of *Bougaivillea* (var *Mrs. Louis Walthen*) was received at these laboratories for propagation. They were planted in our usual propagators. The majority threw out small shoots but there was no callussing or root development. After eighteen months it was decided to try the effect of a proprietary root growth-promoting substance. The cuttings still alive were treated in the normal way, that is, by immersion of the basal ends in a dilute solution for eighteen hours. However, no callussing or rooting took place and it is assumed that this was due to lack of transpiration in the cuttings, which were leafless when treated.

Finally it was decided to try the effect of forcing the growth-promoting substance into the cuttings now almost exhausted of food reserves. The ends of the cuttings were cut off to expose fresh surfaces. The lower ends were submerged to a depth of one inch in the solution contained in a vacuum desiccator which was exhausted until a strong stream of bubbles emerged from the bottom end of each cutting. On breaking the vacuum the solution was forced into the submerged ends. Two or three months after replanting the cuttings, 90 per cent. rooted and are now healthy plants.

The experiment was not planned as a test of the growth promoting substance but was made in a final attempt to save the last remaining cuttings of a variety new to Kenya. So stricking have been the results that the suggestion is put forward that possibly failure to secure rooting with winter cuttings of deciduous plants after treatment with various growth-promoting substances has been due to non-absorption, or to the absorption of too little of the material by the leafless cuttings. (*Tropical Agriculture*, Vol. XVI, No. 4.)

Agricultural Jottings

(From the Director of Agriculture, Madras.)

POSSIBILITY OF SILAGE MAKING ON THE WEST COAST

Cattle form the back bone of Agriculture in the West Coast as in other parts of India. But one has to feel shy of the extremely poor and impoverished condition of the animals, that are kept on the West Coast. There may be several reasons for the poor condition of the cattle in this district, but one prominent reason is under-feeding especially in the growing stages. The statement that fodder is scarce in the West Coast in spite of the abundant growth of green grass during the monsoon months and the large area under paddy may seem a paradox. The first crop harvest of paddy coincides with the monsoon and very little straw of this season can be dried and stored for the cattle. The second crop gives much better straw but most of it is sold away for thatching purposes. Thus very little straw is available for fodder. Growing of fodder crops for summer months is not also an easy affair owing to the paucity of irrigation facilities. The only alternative therefore is to preserve the profuse growth of grass that grows, as the result of the heavy monsoon rains.

West Coast is blessed with abundant rainfall from May to November and green grass springs up everywhere in plenty but part of the grass is cut and used for thatching while the rest is allowed to dry up instead of being converted into valuable fodder. If only cultivators, who own cattle, care to cut and preserve grass available at the close of the monsoon, all the starving animals on the West Coast could be properly fed and their condition improved. The process of preserving green grass is simple and can be easily adopted by any one. The Madras Agricultural Department has issued a Leaflet (No. 7 of 1930) giving full details of the process of silage making and may be of use to those who intend to make silage.

With the cessation of the North-East Monsoon rains in the month of November the paddy cultivator is practically idle and the cultivator can profitably utilise his leisure for this operation. Silage pits of convenient size $15' \times 10' \times 8'$ can be easily dug in high level places without the necessity of retaining walls. Grass of good quality can be had in plenty during this time and can be even purchased very cheap. Layer by layer the grass has to be spread in the pits, compressing it every time to exclude air. Where they are full they are finally mud plastered for the purpose of excluding air, as well as compacting the material. The grass so preserved undergoes certain changes in the pit and will be

ready for utilisation as cattle feed within about 2 to 3 months. This preserved grass is commonly known as 'Silage'. Silage is almost as good as green fodder. It is true that cattle do not relish it when it is first offered to them on account of the smell. This difficulty can however be easily got over if in the early stages the silage is mixed up with straw and fed in small quantities. Later on the animals will eat it with great avidity.

The economic side of the question has been worked out at the Agricultural Research Station, Pattambi, and the figures obtained reveal that 100 lb. of good silage can be made at a cost of Re. 0—2—8 to 0—3—0. During the years 1936-37 and 1937—38, 1,08,760 and 72,965 pounds of green grass were respectively purchased at 0—1—8 per 100 pounds and ensilaged. The total cost of grass and converting it into silage worked out to Rs. 119—10—4 and Rs. 30—3—6 in 1936—37 and Rs. 70—2—0 and Rs. 27—8—0 in 1937—38 respectively. The silage obtained during 1936—37 amounted to 74538 pounds enough for 7 pairs of animals for 5 months when fed on this alone. At the Agricultural Research Station, Pattambi this quantity was enough for 30 heads of animals supplemented with straw.

Thus there is immense possibility for the West Coast farmers to improve their live-stock by preparing silage and adequately feeding them during the summer months. The animals at the Agricultural Research Station, Pattambi, were purchased locally and their present condition will show how far local poor animals could be maintained in good condition by proper feeding and care.

The nearest Agricultural Demonstrator, will be ever ready to help such of those who contemplate silage making.

Correspondence.

To

The Editor, Madras Agricultural Journal.

Sir,

In the note on "bamboos in flower" under "Correspondence" by Sri. K Varadachari in the April issue of your Journal two points have been raised; 1, Whether the flowering has been observed in other parts of the Presidency and 2, how and why the flowering is forced up in times of drought. I propose to offer some explanation for the latter.

When I was touring in Malabar some years ago I met with a *Careya arborea* Roxb. (Tam: *Ayma*; Mal: *Perzhu*) tree in flower which was about a couple of months ahead of the usual flowering time of this species. When examined, the tree was found to have been cut for more than half its width at the base and was left without felling. Owing to this condition, the normal metabolic process of the plant was seriously upset and the plant was not able to take sufficient water for transpiration. Due to this diminished supply of water containing salts, the ratio between the carbo-hydrate content of the plant and the salts in water is upset and as a result the plant flowers for the reproduction of the species Similarly in the case of bamboos, whenever there is insufficient water for transpiration due to prolonged severe drought condition, the plants hasten to flower.

Madras Herbarium,
Coimbatore,
15th May 1939.

(S.) K. Cherian Jacob.

To

The Editor, Madras Agricultural Journal.

Dear Sir,

The two replies published in the March Journal approve of the idea of propaganda through songs. This was recognised early enough by the officers of the Agricultural Department and as a result we have now a few songs published in the form of leaflets. The authors of the two replies have stressed the necessity for talkie films in preference to mere gramophone records. This also is accepted as good in principle and some preliminary correspondence took place about the Department possessing a few such films. Due. probably to lack of funds this proposal has not materialised yet and let us hope it would materialise soon.

In the mean time there is definitely a place and need for the gramophone records suggested. The essential feature about the original suggestion is that it does not involve any financial implications. Efforts are to be made to get good records made. The songs must be sung by first rate artistes. A timely word now and then in responsible quarters from eminent persons (e. g. the ministers) would do the trick. We would then hear the agricultural songs in all sorts of odd places. That would by itself be a long step forward in propaganda. The next stage would come, when funds are available to provide the Agricultural Demonstrators with records and machines as a part of the propaganda equipment for use in the villages. The success of this venture will lead eventually to the production and exhibition of Agricultural talkie films.

The most essential point about this system would be that the songs must be sung by the popular first-rate artistes.

Coimbatore,
14—4—39.

V. Satagopan,
Agricultural Demonstrator.

To

The Editor, Madras Agricultural Journal.

Cereus Pterogonus as a source of pollen for bees.

Sir,

The plant which was designated as *Pachycereus marginatus* in the Madras Agricultural Journal 1938 *26:* 17-26 and as *Cereus Peruvianus* (?) in the Madras Agricultural Journal 1938, *26:* 421-433 has now been correctly determined as *Cereus Pterogonus*, Lem. The latter name, therefore, has to be substituted wherever the former names occur.

Coimbatore,
17th April, 1939

R Ratnam.

Indian Central Cotton Committee.

[We have received the following Press Communique for publication
—*Ed. M. A J.*]

The problems connected with the present position of cotton and the measures for dealing with them formed the principal subject of discussion at the meeting of the Indian Central Cotton Committee held on the 31st March 1939 under the Chairmanship of Sir Bryce Burt, Vice-Chairman of the Imperial Council of Agricultural Research and President of the Indian Central Cotton Committee. The Special Sub-Committee which was appointed to examine the matter from all aspects met on March 27th and 28th under the Chairmanship of Sir Chunilal Mehta, Vice-President of the Committee, and its report and

recommendations, which covered the following points, served as the basis of discussion at the main Committee :—

1. The need for securing a better balanced production of different cottons.
2. Raising the efficiency of cotton cultivation.
3. Restriction of cotton cultivation on marginal lands.
4. Finding of alternative uses for short staple cotton.
5. Intensification of efforts to check malpractices and improvement of marketing to ensure that cottons reach spinners in pure condition to enable their being put to optimum use.
6. Import duty on foreign cotton.
7. Reduction in railway freight rates on cotton.
8. Enhancement of import duty on rayon yarn.
9. Division of areas into zones for growing long, medium and short staple cottons.
10. Provision of proper hedging facilities for staple cottons.
11. Proposed conference of main cotton growing countries to regulate production and export.

In connection with the need for securing better balanced production of different cottons, the Committee expressed the view that, while satisfactory progress in the matter of replacement of short staple cotton by long had been made during the past few years, further investigations appeared necessary, and the process of better balancing of short and long staple cottons in India should continue. With this object it was suggested that efforts should be made to obtain fresh breeding material showing variability and combining resistance to drought and disease with good ginning percentage, lint length etc., from all possible sources including foreign countries, for trial in various tracts. It was stressed, however, that the advantage of the change to the cultivator should, at no stage, be overlooked, and that due consideration should continually be given to what would be the most paying type for him to grow in the long run.

In order to raise the efficiency of cotton cultivation, the starting in major cotton growing tracts of cotton cultivation projects on complete holdings, or preferably in villages, managed and cultivated by the cultivators themselves according to the best system advised by the local agricultural department, and where the results of research work could be concentrated in practice and demonstrated to growers under cultivators' conditions with the improved type or types of cotton best suited to each tract was recommended. Such work, it was suggested, should be carried out by Provincial Departments of Agriculture in collaboration with the Committee in selected holdings or villages.

The curtailment of acreage in India as a means of raising the price of cotton was considered to be of doubtful advantage, but it was decided that if an international conference were held with the object of restricting cotton production, India should be represented at it.

The Committee reiterated its view, expressed on previous occasions, that there should be no relaxation of efforts to reduce mixing and other malpractices which prevented certain Indian cottons from being used to the best advantage and which adversely affected the cultivator. The application of the Cotton Transport Act, the Cotton Control Act and the Cotton Ginning and Pressing Factories Act, wherever possible, was advocated. It was emphasised that an important seed scheme in Sind was being held up as one of the conditions for the grant laid down by the Committee, viz., the application of the Cotton Ginning and Pressing Factories (Bombay Amendment) Act to the Province, had not been given effect to.

Considerable discussion centred round the recent increase in import duty on foreign cotton and the following two resolutions were passed, the second by a majority of 26 to 6.

1. "The Indian Central Cotton Committee desires to place it on record that it has not recommended an increase in the duty on all foreign cotton. It reiterates the view expressed in 1937 and 1938 that should the parity of Indian and imported cotton move to a point justifying such action, the import duty should be increased on all cottons which compete with Indian cotton, i. e., cottons below 1″ staple at present".

2. "The Indian Central Cotton Committee is of the opinion that the recent increase in import duty on foreign cotton to be effective in helping the production of long staple cotton in India should have been accompanied by restriction on the import of foreign yarn and cloth or a corresponding increase in duty on such imports".

The report that the U. S. A. intended granting an export bounty on American cotton was also considered by the Committee and the following resolution submitted to it by the Wider Markets Sub-Committee was adopted :—

"In view of the news received recently to the effect that U. S. A. intend granting an export subsidy for American cotton to the extent of 1·25 to 2 cents per lb. of cotton exported from the U. S. A., this Committee recommends that the Indian Central Cotton Committee should consider without delay the necessity of the indigenous cotton market being preserved for Indian cotton by urging the Government of India to adequately raise import duties on subsidised cotton, cotton cloth and yarn in such effective manner as will prevent cloth and yarn made out of bounty-fed American cotton from replacing manufactures of Indian cotton, and to take such other effective steps in consultation with the Indian Central Cotton Committee as may appear feasible".

In regard to the provision of better hedging facilities for staple cottons, a special Sub-Committee was appointed to consider and report on the suggestions made for the widening of the Broach Hedge Contract and the Karachi 4F Contract, for the establishment of a separate contract for staple cottons and for trading to be permitted in the Broach Contract in new crops a year ahead.

Subject to examination of final details by the Standing Finance Sub-Committee, the Committee approved of the recommendation of the Technological Research Sub-Committee for the purchase of a pilot plant for determining the cost of production of chemical cotton from linters, waste and cheap cotton. Sanction was also provisionally accorded to a scheme for carrying out investigations at the Technological Laboratory for improving the ginning of Indian cottons involving an estimated non-recurring expenditure of Rs. 24,500 and a recurring charge of Rs. 4,600 per annum.

A new cotton breeding scheme for the production of long staple cotton for cultivation in Sind at a total cost of Rs. 2,23,70 over a period of 5 years was also provisionally sanctioned.

Before the proceedings of the meeting terminated, the Committee placed on record its appreciation of the valuable service rendered by Sir Bryce Burt during the past 18 years of his association with it, first as Secretary, then as Member and finally as its President. It expressed the view that the success of the work of the Committee could in large measure be said to be due to his advice, guidance and close attention to problems connected with cotton development.

Crop & Trade Reports.

Cotton—1938-39—fifth or final report. The average of the areas under cotton in the Madras Province during the five years ending 1936—37 has represented 9·6 per cent of the total area under cotton in India.

The area under cotton in the Madras Province in 1938—39 is estimated at 1,957,600 acres as against 2,556,100 acres for the corresponding period of last year and 1,873,900 acres according to the forecast report issued in February. The present estimate for Province represents a decrease of 23·9 per cent as compared with the finally recorded area of 2,572.024 acres in 1937—38. The final estimate of last year fell short of the actuals by 0·6 per cent.

The decrease in area in the current year as compared with the area in 1937-38 occurs in all the important cotton growing districts of the Province and is attributable largely to unfavourable seasonal conditions.

Picking of cotton is in progress and may be finished in about a month.

Normal yield is expected in Kurnool, Anantapur, Madura, Ramnad (unirrigated cotton), Tinnevelly (Tinnevellies cotton) and South Kanara. A yield below normal is expected in the other districts mainly owing to drought. The estimated yield is lowest in Coimbatore (55 per cent for dry Karunganni and 60 per cent for irrigated Karunganni, dry Uppam, Nadam and Bourbon). In East Godavari, the crop was damaged by the cyclone in November and the yield is therefore estimated at only 70 per cent of the normal.

The seasonal factor for the Province as a whole works out to 86 per cent of the average for irrigated cotton and 95 per cent for unirrigated cotton, the corresponding figures according to the Season and Crop Report of last year being 94 per cent and 85 per cent respectively. On this basis, the yield works out to 388,900 bales of 400 lb. lint as againt 504,510 bales of last year which represents a decrease of 22·9 per cent. The yield in an average year is estimated at 506,570 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

The estimated area and yield under the several varieties are given below :—

(Area in hundreds of acres, i. e., 00 being omitted ; yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted.)

Variety.	Area.		Corresponding yield.	
	1938--39. Acs.	1937—38. Acs.	1938—39. Bales.	1937—38. Bales.
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia ...	152,0	264,8	82,0	159,9
Dry Cambodia ...	187,9	312,4	35,6	63,4
Total, Cambodia ...	339,9	577,2	117,6	223,3
Karunganni in Coimbatore	62,0	142,0	7,7	28,9
Uppam in the Central districts.	20,1	34,9	2,8	5,2
Nadam and Bourbon ...	3,3	25,2	2	1,1
Total, Salems	85,4	202,1	10,7	35,2

Tinnevellies*	...	513,2	547,5	132,2	134,0
Northerns and Westerns	...	890,0	1,091,0	107,8	89,7
Cocanadas	...	123,3	131,3	19,9	22,2
Others	...	5,8	7,0	7	8
Province	...	1,957,6	2,555,1	388,9	505,2

* Includes Uppam, Karunganni and mixed country cotton in the south.

The table below gives final information so far as it is available on the crop of 1937—38:—

(Figures in hundreds of bales of 400 lb. lint, i. e, 00 being omitted.)

Particulars.	South.		Deccan, Northerns and Westerns.	Rest of the Province Cocanadas and others.	Total.
	Tinnevellies and Salems.	Cambodia.			
(1)	(2)	(3)	(4)	(5)	(6)
	Bales.	Bales.	Bales.	Bales.	Bales
1. Pressed at presses and loose cotton received at mills in 1938—39.	164,7	249,0	106,5	32,3	552,5
2. Add estimates of extra factory consumption.	6,0	Nil.	6,0	4,0	16,0
3. Total crop of 1937—38.	170,7	249,0	112,5	36,3	568,5
4. Yield as estimated in April 1938.	169,2	223,3	89,7	23,0	505,2
5. Yield as estimated in the Season and Crop Report.	187,8	213,6	81,1	22,0	504,5

Note—(1) *Item* 1. The entries mainly relate to the crop of 1937—38. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) *Item* 2. The figures are approximate.

(3) Figures of carry over of crop are not available nor are figures of arrivals and despatches by road of the different varieties available.

7. The average wholesale price of cotton lint per imperial maund of 82-2/7 lb. as reported from important markets on 11th April 1939 was Rs. 14—5—0 for Cocanadas, Rs. 14—3—0 for Red-Northerns, Rs. 13—2—0 for White Northerns, Rs. 11—10—0 for Westerns (Mungari crop), Rs. 14—3—0 for Westerns (jowari crop), Rs. 25—4—0 for Coimbatore, Cambodia, Rupees 19—14—0 for Southern Cambodia, Rs. 21—9—0 for Coimbatore-Karunganni, Rs. 19 for Tinnevelly-Karunganni, Rs. 18—2—0 for Tinnevellies, and Rs. 17—14—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 6th February 1939, these prices reveal a rise of about 6 per cent in the case of Tinnevellies, 5 per cent in the case of Southern-Cambodia and Westerns (jowari crop), and one per cent in the case of Coimbatore-Cambodia and Tinnevelly-Karunnganni and a fall of 5 per cent in the case of Cocanadas, 4 per cent in the case of Red-Northerns, 3 per cent in the case of Westerns (Mungari crop), and 2 per cent in the case of White Northerns, the prices of Coimbatore-Karunganni and Nadam cotton remaining stationary or practically stationary. *(From the Director of Industries and Commerce).*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 19th May 1939 amounted to 202,356 bales of 400 lb. lint as against an estimate of 3,88,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 177,449 bales. 164,536 bales mainly of pressed cotton were received at spinning mills and 56,282 bales were exported by sea while 79,167 bales were imported by sea mainly from Karachi, Egypt and Bombay.

(From the Director of Agriculture, Madras).

College News & Notes.

Students' Corner. The practical examinations for the B. Sc. Ag. Degree in Agriculture came to a close on the 1st of this month. The results of the University Examinations are published elsewhere in this number.

Personal. We are glad to note that Sri. P. Uttaman, B. Sc. Ag., M. Sc., Assistant to Paddy Specialist, Pattambi, has been offered and accepted the post of first Research Assistant in Paddy under the Government of Orissa.

Visitors. Sri. Rao Bahadur M. R. Ramaswami Sivan, Retired Principal, Agricultural College, has been here in the Estate for over a month now on a short holiday.

A party of health officers under the leadership of Dr. Akroyd of the Nutritional Research Laboratories, Coonoor, visited the College and Research Institute on the 23rd May.

Officers' Club. In the Presidency Auction and Contract Bridge tournament conducted under the auspices of the Cosmopolitan Club, Coimbatore, the following members of the officers' Club came out successful.

Contract Bridge. Winners : T. S. Ramasubramania Ayyar and M. S. Kylasam.
Runners up : M. A. Sankara Ayyar and C. S. Krishnaswami.

Progressive Contract Bridge. North-south winners :
M. S. Kylasam and T. S. Ramasubramania Ayyar.

Fodder and Grazing Committee. We are glad that Mr. Cherian Jacob has been nominated by the Government of Madras as a member of the Special Fodder and Grazing Committee, constituted in pursuance of the recommendations of the preliminary committee of Forest Officers which the Government of India appointed in 1936 to advise the Animal Husbandry wing of the Board of Agriculture and Animal Husbandry in the matter of better utilization of the forest areas for grazing.

The function of the Provincial Committee is to investigate the re-classification of waste land outside Government forest and select areas fit for the production of fodder or for management as grazing grounds. The Committee is also to advise the Government as to the best agency for management of lands selected for fodder and grazing purposes and is to indicate the lines along which investigations are needed and improvements in management are required.

Entomological Society of India—S. India Branch. Sri. T. V. Subramaniam, Secretary, S. Indian Branch of the Entomological Society of India, writes to us under date Coimbatore, the 15th May 1939.

" A meeting of the Entomological workers resident in Coimbatore, was held on 3rd May 1939 at the Laboratory of the Government Entomologist, Agricultural College and Research Institute, presided over by Sri. M. C. Cherian. A South Indian Branch of the Entomological Society of India with headquarters at Coimbatore was formed with Sri. M. C. Cherian as President and Sri T. V. Subramaniam as Secretary."

The late Rajagopal. G. Mal.

It is with deep regret that we have to record the sad demise, on 21-3-39, following an attack of pulmonary tuberculosis of Rajagopal G. Mal, L. Ag. Agricultural Demonstrator, Nanguneri, at the age of fifty. A good sportsman, he braved the difficulties and disappointments that fell to his lot; but, was no match to the cruel disease to which he succumbed.

We offer our sincere condolence to the bereaved family.

Weather Review—APRIL 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·8	1·4
	Calingapatam	0·5	-0·4	0·9
	Vizagapatam	0·0	-0·7	2·7
	Anakapalli *	0·0	-1·3	1·7
	Samalkota*			
	Maruteru*	0·2	-0·6	1·4
	Cocanada	0·5	-0·1	2·7
	Masulipatam	0·1	-0·5	0·5
	Guntur*	0·4	-0·3	0·9
Ceded Dists.	Kurnool	0·6	0·0	0·6
	Nandyal*	0·3	-0·7	0·4
	Hagari *	0·4	-0·6	0·4
	Siruguppa*	0·1	-1·0	0·2
	Bellary	1·3	+0·5	1·3
	Anantapur	2·5	+2·0	2·5
	Rentachintala	0·4	...	1·4
	Cuddapah	1·2	+0·7	1·7
	Anantharajupet *	5·7	+1·5	9·2
Carnatic	Nellore	2·9	+2·5	4·0
	Madras	5·2	+4·7	6·2
	Palur *	8·4	+6·2	11·7
	Tindivanam *	4·5	+3·6	6·2
	Cuddalore	9·9	+9·3	13·7
Central	Vellore	5·4	+4·4	7·6
	Salem	5·7	+3·9	7·2
	Coimbatore	1·3	-0·1	4·0
	Coimbatore A. C. & R. I.*	1·1	-0·8	3·7
	Trichinopoly	5·6	+3·9	7·5

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	11·3	+10·7	12·9
	Aduthurai *	10·3	+9·5	13·0
	Madura	7·1	+5·0	9·7
	Pamban	2·2	+0·6	5·5
	Koilpatti*	2·6	-0·5	5·4
	Palamkottah	1·0	-1·5	4·0
West Coast	Trivandrum	6·7	+2·2	8·1
	Cochin	11·3	+6·6	13·6
	Calicut	6·9	+3·6	7·0
	Pattambi *	6·9	+3·4	8·0
	Taliparamba *			
	Kasargode *	3·7	+1·2	3·7
	Nileshwar*	2·5	+0·7	2·5
	Mangalore	5·0	+3·7	5·0
Mysore and Coorg	Chitaldrug	4·7	+3·7	4·7
	Bangalore	6·1	+4·8	7·1
	Mysore	2·1	-0·3	3·2
	Mercara	1·4	-1·2	2·4
Hills	Kodaikanal	5·7	+1·4	15·1
	Coonoor			
	Ootacamund *	3·2	-0·6	5·5
	Nanjanad *	1·8	-1·4	4·4

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

The unsettled conditions in the south Bay of Bengal on the 12th developed into a depression on the 13th, intensified into a storm on the 14th and after causing fairly wide-spread rainfall in South East Madras, South of the Presidency and the West Coast, moved away on the 18th. Rainfall was in large excess all

over the Presidency with the exception of the Circars and West Deccan. Skies were moderately to heavily clouded. The humidity was in defect in parts of South East Madras and North Madras coast. Maximum and minimum temperatures were below normal. Rentachintala recorded a maximum of 110°F on the 30th.

Chief amounts of rainfall.

Negapatam	5·5" on 13th.
Chidambaram	6·1" on 16th.
Cochin	5·1" on 14th.
Tirukoilur	5·1" on 16th.

Weather Report of the Agricultural College & Research Institute Observatory.

Report No. 4/39.

Absolute maximum in shade	...	99·5°F
Absolute minimum in shade	...	63·8°F
Mean maximum in shade	...	94·4°F
Departure from normal	...	-1·2°F
Mean minimum in shade	...	72·0°F
Departure from normal	...	-1·1°F
Total rainfall for the month	...	1·1"
Departure from normal	...	-0·8
Heaviest fall in 24 hours	...	0·6"
Number of rainy days	...	2
Mean daily wind velocity	...	2·3 m. p. h.
Departure from normal	...	-0·3
Mean humidity at 8 hours	...	73·5
Departure from normal	...	+2·4

Summary. But for the local thundershowers on the 8th, 14th, 16th and 23rd, the month was practically dry. Skies were moderately to heavily clouded and the humidity was largely in excess. The mean maximum, the mean minimum and the rainfall were all in defect. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Transfers.

Name of officers.	From	To
Sri K. Raghava Achariya,	Asst D. A. Cuddalore,	Asst. D. A., Cuddapah.
,, R. Swami Rao,	Asst. D. A. Cuddapah,	Asst. D. A. Cuddalore.

Subordinate Services.

1. Transfers.

Name of officers.	From	To
Sri. P. Gopalakrishnan,	F. M., A. R. S., Nanjanad,	Offg. F. M., A. R. S., Koilpatti.
,, A. Subba Rao,	Off. F. M. A. R. S. Kodur.	A. D., Siruguppa.
,, K. Krishna Hegde,	A. A. D., Kasargode,	Govt. Botanical Gardens, Ootacamund.

Sri K. P. Sankunni Menon,	F. M., Govt. Botanical Gardens, Ootacamund,	F. M. Central Farm.
,, V. Satagopan,	A. D., Coimbatore,	Secy, Groundnut Market Committee, Cuddalore.
,, P. Narayanan Nair,	F. M. Nanjanad,	A. D., Coimbatore.
,, K. M. Venkatachalam,	A. A. D. Cuddalore,	Market yard Supdt. Groundnut Market Committee, Cuddalore.
,, M. A. Balakrishna Ayyar,	A. D. Vellore,	F. M., A. R. S., Koilpatti.
,, M. Gopala Unnithan,	A. D., Gudiyatam,	A. D., Vellore.
,, Edwin Amirtha Raj,	...	F. M., A. R. S., Nanjanad.
,, A. M. Muthayya Nattar,	A. D., Tirupur,	Market yard Supdt., South Arcot, G. M. C., Cuddalore.
,, P. Janakirama Ayyar,	A. D., Tirukoilur,	Market Yard Supdt. South Arcot, G. M. Committee, Cuddalore.
,, A. Chidambaram Pillai,	A. D. Madura,	Market Yard Supdt., South Arcot, G. M. Committee, Cuddalore.
,, R. Vasudeva Rao Naidu,	A. D., Bhimlipatam,	Secretary, Tobacco Market Committee, Guntur.
,, D. C. Hanumantha Rao,	A. D., Kovvur,	Agricultural Marketing Asstt., Bezwada.
,, A. H. Subramania Sarma,	F. M. Central Farm, Coimbatore.	Agricultural Marketing Asstt., Coimbatore.
,, P. S. Athmarama Ayyar,	A. D., Kumbakonam,	Agricultural Marketing Asstt., Trichinopoly.
,, K. Regunatha Reddy,	A. D., Chandragiri,	Agricultural Marketing Asstt., Madras.
Janab Shaik Hussan Saheb,	A. D., Cuddapah,	A. D., Kamalapuram.

2. Leave.

Name of officers.	Period of leave.
Sri C. Krishnan Nayar, Asst. to Mycologist, Coimbatore.	L. a. p. for 4 months from 12—5—39.
,, M. Somayya, F. M., A. R. S., Nandyal.	L. a. p. for 1 month from 6—5—39.
,, L. Neelakantan, Asst. in Cotton, A. R. S., Nandyal.	Extension of l. a. p. for 22 days from 24—5—39.
,, R. Venkatarama Ayyar, A. A. D., Virdachalam.	L. a. p. for 3 weeks from 8—5—39.
,, S. Veeravarada Raju, A. D., (on leave)	Extension of l. a. p. on m. c. for 2 months from 19—5—39.
,, R. Vasudeva Rao Naidu, A. D., Bhimlipatam.	L. a. p. for 1 month from the date of relief.
,, T. Lakshmipathy Rao, A. D., Kovvur.	L. a. p. on m. c. for 1½ months from 29—4—39.
,, K. Balaji Rao, A. A. D., Siruguppa.	L. a. p. for 3 months from 15—5—39.
,, K. Hanumantha Rao, A. A. D., (on leave)	Extension of l. a. p. for 1 month and 28 days from 29—4—39.

Sri. P. Vishnusomayajulu, Asst. Mycology, Coimbatore.	L. a. p. for 14 days from 25--5--39.
" D. Panakala Rao, A. D., Ramachandrapuram.	L. a. p. for 3 weeks from the date of relief.
" N. C. Tirumalachari, F. M., Cotton Breeding Station, Coimbatore.	Extension of l. a. p. for 1 month from 15—5—39
" C. V, Sankaranarayana Ayyar, Sub-Asst., Paddy Station, Coimbatore.	L. a. p. for 1 month from 11—5—38.
" K. M. Jacob, A. D., Manantody,	L. a. p. for 2 months from 10—5—39.
" S. Krishnamurthy, F. M., Central Farm, Coimbatore.	L. a. p. for 1 month from 8—5—39.
" P. S. H. Narayanaswami Naidu, F. M., S. R. S., Gudiyattam,	L. a. p. for 2 months from 24—5—39.
" V. Chidambaram Pillai, F. M., A. R. S., Koilpatti,	L. a. p. for 2 months from 8—5—39.
" S. Sundram, Asst. in Cotton Coimbatore.	L. a. p. for 4 months from the date of relief.
" G. K. Chidambaram, Asst. in Chemistry, Coimbatore.	L. a. p. for 1 month from 8—5-39.
" S. V. Doraiswami Iyer, F. M., A. R. S, Guntur.	L. a. p. for 1 month from 4—5—39.
" J. Suryanarayana, A. D. Gurzala,	L. a. p. on m. c. for 1 month from 4—5—39.
" M. Narasimham, A. D., Guntur.	L. a. p. on m. c. for 1 month from 3—5—39.
" D. Hanumantha Rao, A. D., Kothapetta.	L. a. p. on m. c. for 1 month from 24—4--39.
" C. S. Balasubramaniam, Asst. in Entomology, Cuddapah.	Extension of l. a. p. on m. c. for 6 weeks.
" S. Ponnuswami Naidu, A. A D. Ambasamudram.	L. a. p. for 1 month from 21—4—39.
" P. V. Somu Ayyar, A. A. D, (on leave)	Extension of l. a. p. on m. c. for 1 month from 6—5—39.
" S. Mayandi Pillai, Asst. in Cotton, A. R. S., Koilpatti.	Extension of l. a. p. for 4 months on m. c. from 13-4-39.
" S. Bhima Raju, A. A. D., Tadpatri.	Extention of l. a. p. on m. c. for 2½ months from 3-5-39.
" C. A. S. Ramalingam Pillai, A. A. D., Ariyalur.	Extension of l. a. p. on m. c. for 6 weeks from 9-4-39.
" G. J. Balaji, A. A. D., Pattukottai.	Extension of l. a. p. on m. c. for 3 months from 3-4-39.
" M. K. Padmanabhan, Asst. in Paddy, A. R. S., Pattambi,	L. a. p. on m. c. for 3 months from 15-4-39.
" M. Bhavani Shanker Rao, Asst. in Oilseeds, Coimbatore.	L. a. p. for 30 days from 24-4-39.
" C. S. Sankaranarayana Ayyar, A. D., Hosur.	L. a. p. for 19 days from 25-5-39,
" M. C. Menon, A. D., Tirupattur.	L. a. p. for 1 month from 18-5-39.
" T. D. Eswara Ayyar, Asst. F. M., Sim's Park, Coonoor.	L. a. p. for 15 days from 24-5-39,
" M. K. Gopalan, A. D., Proddatur.	L. a. p. for 1 month from 29-5-39.
" B. G. Narayana Menon, Off. F. M., A. R S., Nileshwar.	Extension of l. a. p. for 20 days from 12-5-39.
" V. V. S. Varada Rajan, F. M., A. R. S., Guntur.	L. a. p. for 1 month from 25-3-39.